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I, LEANNE MYNOTT, MANAGER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003903648 for a patent by CASTALLOY MANUFACTURING PTY LTD as filed on 16 July 2003.

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Twenty-eighth day of July 2004

LEANNE MYNOTT
MANAGER EXAMINATION SUPPORT AND SALES

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Patents Act 1990

ORIGINAL

PROVISIONAL SPECIFICATION FOR AN INVENTION ENTITLED

Invention Title: CYLINDER LINER IMPROVEMENTS

Name of Applicant: CASTALLOY MANUFACTURING PTY LTD

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The invention is described in the following statement:

The present invention relates to cylinder liners for alloy engine blocks.

It is common practice in the automotive and engine manufacturing industry to keep the weight of the component parts of a vehicle to a minimum if possible, as this has benefits associated with both the handling and fuel consumption of the complete vehicle. Traditionally engine blocks have been cast from cast iron, with the cylinder bores carefully machined to receive the pistons of the engine. However with the introduction of aluminium cylinder blocks, it is necessary to have in the cylinder block an iron cylinder liner in which the piston of the engine operates, due to the fact that aluminium is not a sufficiently wear resistant metal.

As a part of their normal production, conventional cylinder liners are machined in the internal diameter. This machining gives the cylinder liner a constant internal diameter along its length.

The cylinder liners are prepared for casting, and then positioned on a core, and more specifically a barrel core, which may be separately formed and assembled onto the crankcase core, or formed integrally with the crankcase core. The remainder of the mould is then assembled around the core and cylinder liners, and the mould is then filled, casting the cylinder liners into the engine block. The positional accuracy of cylinder liners relative to one another within a casting is determined in a large part by the dimensional accuracy and assembly clearances of the mould cores that support the cylinder liners during the filling of the mould.

Once cast, an engine block is machined to ensure, among other things, that the cylinder bores have uniform cylinder liner wall thickness. This places further importance upon positional accuracy of the cylinder liners during casting.

As a byproduct of its manufacture, a barrel core is formed with a draft, or external diametral taper, extending from its base toward the distal ends of the

barrel core, so as to permit removal of the core from the core box tooling once formed.

When a conventional cylinder liner is disposed upon a barrel core, there is a mismatch, which increases along the length of the cylinder liner. Although the cylinder liner is located tightly at the head slab end of the barrel core, at the distal end of the barrel core, the mismatch is its most pronounced, permitting a degree of movement, which can potentially result in a misalignment of the cylinder liner in the casting.

It is an object of the present invention to provide a cylinder liner that overcomes or at least substantially ameliorates the problems associated with the cylinder liners of the prior art.

It is a further object of the present invention to provide a cylinder liner with a tapered internal bore, which is machined so as to be complementary with the draft of the barrel core.

Other objects and advantages of the present invention will become apparent from the following description, taken in connection with the accompanying drawings, wherein, by way of illustration and example, an embodiment of the present invention is disclosed.

In one form of this invention although this may not necessarily be the only or indeed the broadest form of this there is proposed an engine block mould, including at least one core, and at least one cylinder liner, wherein the core has an outer diametral taper along at least a portion of its length, and the cylinder liner has a substantially matching internal diametral taper along at least a portion of its length.

Preferably, the taper of the core and the cylinder liner, extends from the crankcase forming region toward the distal ends of the barrel core.

Preferably, the taper of the cylinder liner, and the taper of the core, is applied along the entire length of each.

Preferably, the core is a sand barrel core.

Preferably, the sand barrel core is fixed to the crankcase core.

Alternatively, the sand barrel core is fixed to the slab or base core.

Using a barrel core that is fixed to the slab or base core would be required in instances where it is desired to cast the cylinder block in an orientation that is inverted relative to the orientation of the block in use.

In a further form of the invention it can be said to lie in a method of assembling an engine block mould including the steps of, providing a core with at least one barrel having an outer diametral taper along at least a portion of its length, and disposing upon the core, via manipulation means, a cylinder liner with a matching internal diametral taper along at least a portion of its length.

Preferably, the manipulation means is a robot.

Preferably, a further step includes casting molten metal in the mould to form an engine block.

Preferably, a further step includes machining the cylinder liners again so that they have a substantially constant internal diameter along their length.

Due to the increased guidance provided by the complementary drafts on the barrel core and cylinder liner, the task of assembly of a mould prior to casting lends itself to performance by robotic means.

Furthermore, cylinder liners are generally preheated prior to casting in order to reduce process related defects, which can result if a cylinder liner of ambient temperature comes into contact with the molten metal. If a fluidised sand bed is used to simultaneously clean and preheat the cylinder liner, the capability to use a robot has the added advantage that the robot can be used to take a cylinder liner directly from the fluidised bed, and assemble it directly into the mould, reducing the effects of heat dissipation.

A further advantage associated with a cylinder liner according to the present invention where the core is a barrel core fixed to the crankcase core, is that in a subsequent casting operation the liner is tapered toward the fire face and mould risers, with the thickest part of the liner being at the crankcase end of the mould, which will in turn have the greater volumetric heat capacity. The volumetric heat capacity will be reduced as the liner tapers, setting up an optimized thermal gradient that promotes directional solidification towards the risers.

For a better understanding of this invention it will now be described with respect to the preferred embodiment which shall be described herein with the assistance of drawings wherein:

Figure 1 is a cross-sectional view of the cylinder liner according to the preferred embodiment of the present invention;

Figure 2 is a cross sectional view of the cylinder liner in Figure 1, showing it disposed upon a barrel core, prior to casting; and

Figure 3 is a cross sectional view of a conventional cylinder liner disposed upon a barrel core prior to casting, illustrating the mismatch.

Now referring to the illustrations, and in particular to Figure 1, there is a cylinder liner 1, with an internal bore 2 that is tapered along its length, such that the diameter of the bore is greater at A than it is at B.

When the cylinder liner 1 is disposed upon a sand barrel core 10, as illustrated in Figure 2, there is no mismatch, as the draft on the liner and the draft on the core are complimentary.

If a conventional cylinder liner 20, is disposed upon a barrel core 10, as illustrated in Figure 3, there is a mismatch C, between the internal diameter of the liner, and the outer diameter of the core. This mismatch introduces a potential for misalignment of the liner.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred embodiment, it is recognised that departures can be made within the scope of the invention, which is not to be limited to the details described herein but is to be accorded the full scope of the appended claims so as to embrace any and all equivalent devices and apparatus.

Dated this 16th day of July 2003

CASTALLOY MANUFACTURING PTY LTD
By their Patent Attorneys,
COLLISON & CO.

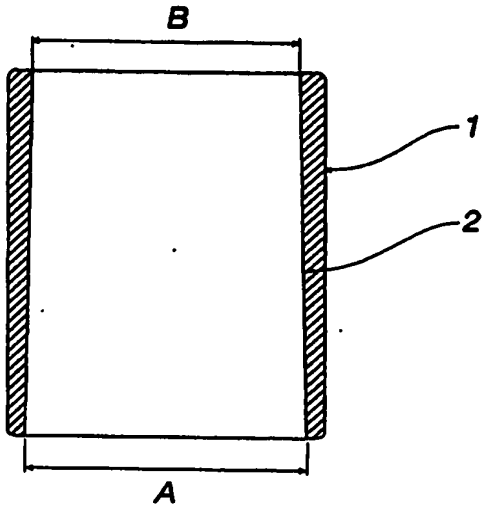

Fig 1

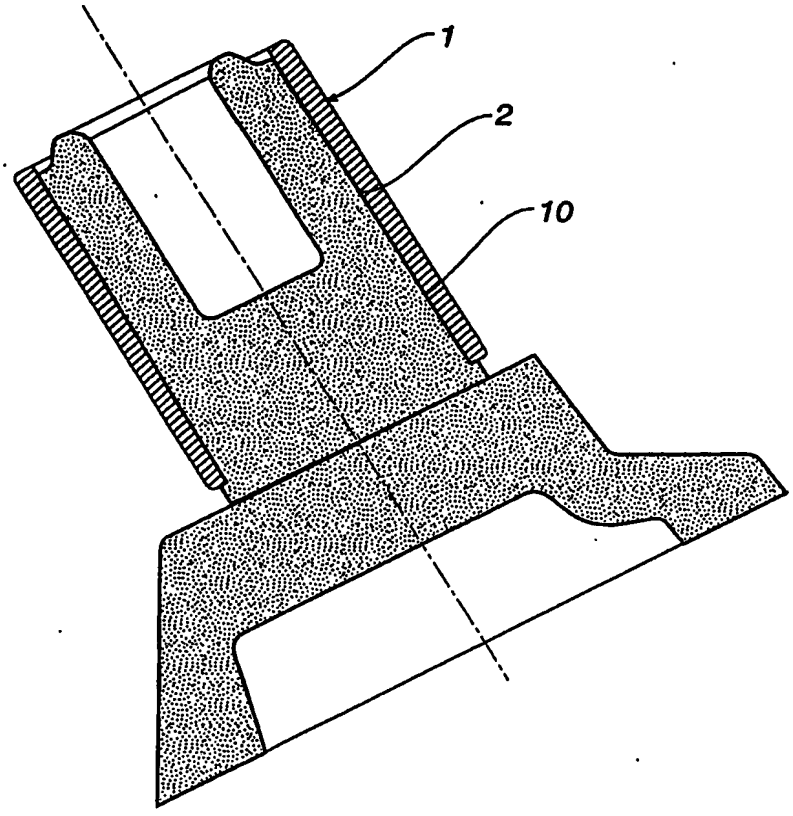

Fig 2

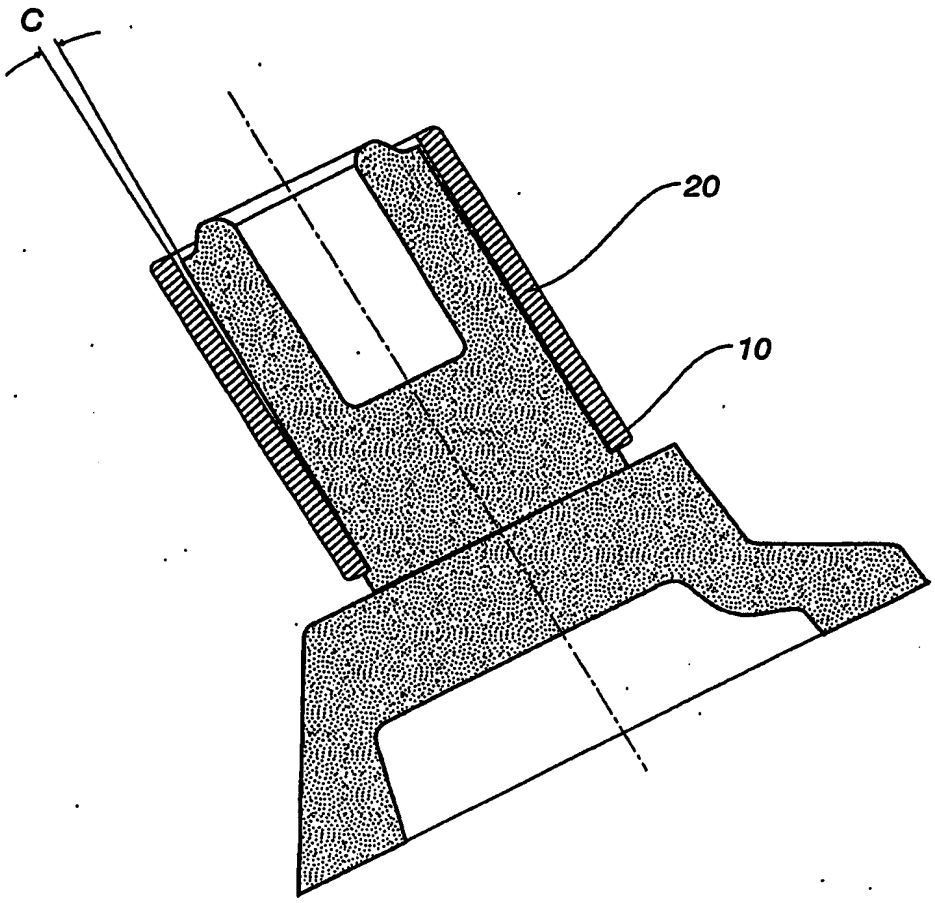

Fig 3